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## EUROPEAN PATENT APPLICATION

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54 Antenna system for a vehicle.

57 The invention relates to an antenna system for a vehicle and particularly for a radio telephone, the system comprising an antenna (1) fastened to the outside of the vehicle and receiving and/or transmitting signals, the antenna (1) being in galvanic com-

munication (8) with the interior of the vehicle. Inside the vehicle there is an internal antenna (2) connected galvanically to the external antenna (1). The radio telephone includes a separate antenna of its own.

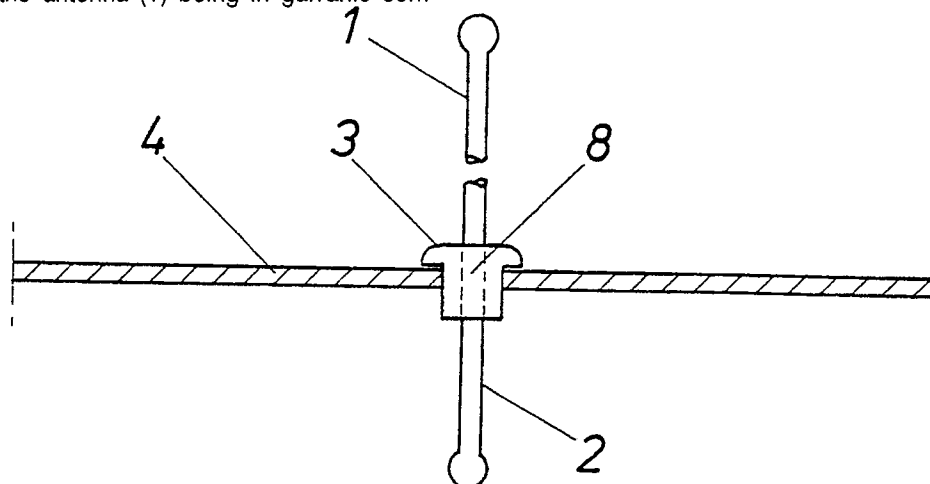


Fig. 1

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## ANTENNA SYSTEM FOR A VEHICLE

This invention relates to an antenna system for a vehicle and particularly, but not exclusively, to a car antenna system. More particularly this invention has special, but again not exclusive, reference to a car antenna system designed for cellular handheld radio telephones. It is possible to get handheld radio telephones to function inside a car without interferences by using a car installation kit and connecting it to an antenna mounted on the car roof or in another place favorable for the operation. If there is no car installation kit available, or if such an installation kit is not purchased due to the cost, it is possible to use a separate cable, which is connected to the handheld radio telephone's antenna connector and which is in communication with an antenna outside the car. This antenna system has an inconvenience in that when a change to car operation is made, the cable has to be connected to the antenna connector, whereby the primary antenna of the handheld radio telephone first has to be removed from the connector. When a change is made to portable operation, the cable accordingly has to be disconnected and the primary antenna of the handheld radio telephone connected to the connector. Moreover, this antenna system has a drawback in that the antenna cable connector will get dirty, when it is connected and lies on the floor of the car, and further it will be in the way when the car is used. In accordance with current trends the handheld radio telephones are more and more often equipped with a fixed antenna, without any antenna connector. The major drawback with these handheld radio telephones is that no separate antenna cable may be connected to them, and the telephone's own antenna is the only connection to the external radio telephone system. Inside the car the telephone may be in the user's pocket, on the seat, on the floor of the car, or in another place unfavorable with respect to the radio field. Directional fading is further very strong inside the car when the car's position changes with respect to the base station. The object of the present invention is to obviate said drawbacks and to provide an antenna system for a vehicle, particularly for a car, the system connecting the isolated interior of a car or other vehicle with the external radio field, particularly with the cellular network of a radio telephone system. The present invention is defined in the appended claims and provides an antenna system comprising an internal antenna located inside the vehicle and galvanically connected to said antenna outside the vehicle. The external antenna can be located so that its field pattern is optimal with respect to the base station, for example on the roof or in a window of the car, and the

external antenna is, with minimal losses, in galvanic communication with the second antenna inside the car, so that signals can travel in both directions. An antenna on the car roof or fastened to a window will transfer the received signal with good strength to the antenna inside the car, which in turn will relay the signal to a receiver, for example a handheld radio telephone with its own antenna located inside the car, the receiver thus receiving a uniform signal with natural fading, and in no way being sensitive to shades caused by the metal body of the car. The uniform field pattern amplifying in the direction of the base station is also utilised during transmission. The internal car antenna may have less directional strength and therefore it can be smaller, forming no obstacle when the car is used. A suitable internal antenna is for example a quarter-wave length flexible plastic coated copper wire fastened to the interior of the car roof. The solution is very inexpensive but highly effective. In a preferred embodiment of the invention the antenna system comprises an antenna pair in galvanic contact with each other through the car roof, the internal antenna being a quarter-wave length, flexible plastic coated copper wire fastened to the interior of the car roof. The external antenna can also be a removable antenna fixed to the car roof with a magnet, for example, the external antenna communicating with the internal antenna inside the car via a cable through a body sealing, for example a door packing, or the end of the cable being formed into an internal antenna by stripping the cable. The stripped end of the cable can be connected, for example by a rapid connector, to the car seat. The antenna pair forming the antenna system may also be fastened to a window of the car and galvanically connected by a cable conducted through the window or through a packing between the window and the body. The invention will now be described in greater detail, by way of example, with reference to the accompanying drawings, in which :- Figure 1 shows a side view cross section of an antenna pair arranged through a car roof, Figure 2 shows a side view cross section of an external antenna fixed to a car roof with a magnet and a cable conducted inside between door packings, including a stripped cable end, and Figure 3 shows a side view of an antenna pair arranged in a car window.

In Figure 1, an antenna system according to the invention has an external antenna at 1 and an internal antenna at 2. The external antenna 1 and the internal antenna 2 form an antenna pair, in which both antennas 1,2 are in galvanic contact 8 with each other. The antenna pair 1,2 is arranged in

an opening formed in the car roof 4, and they are fixed to this opening by an insulation 3. In this solution the internal antenna 2 can be a quite simple, quarter-wave length, flexible plastic coated copper wire. In Figure 2, the external antenna 1 is fixed with a magnet 7 to the car roof 4 or other metallic structure of the car. The external antenna 1 is in galvanic contact with the interior of the car via a cable 8, which is conducted through the door packing (not shown), and the end of which is stripped in order to form the internal antenna 2. The internal antenna 2 can be fastened, for example by a rapid connector, to the car seat (also not shown). In Figure 3 the antenna pair 1,2 is fixed to a car window and connected to each other via a galvanic connection, for example a wire 8, conducted through a hole made in the window, the antenna pair 1,2 being fixed to the pane or window of the car with a pane or window connector 6.

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### Claims

1. An antenna system for a vehicle and particularly for a radio telephone, the system comprising an antenna (1) fastened to the outside of the vehicle and receiving and/or transmitting signals, the antenna (1) being in galvanic communication (8) with the interior of the vehicle, characterised by an antenna (2) located inside the vehicle and in galvanic contact with said antenna outside the vehicle.

2. A system according to claim 1, characterised by the internal antenna (2) being a quarter-wave length, flexible plastic coated copper wire.

3. A system according to claim 2, characterised in that the antenna pair are galvanically connected through the roof (4) of the vehicle.

4. A system according to claim 1, characterised by an external antenna (1) fixed with a magnet (7) to metallic structure (4) of a vehicle, and by a cable (8) conducted from the external antenna (1) to the interior of the vehicle through a body packing, preferably a door packing, the cable end being connected to an internal antenna or being stripped to form an internal antenna (2).

5. A system according to claim 4, characterised in that the metallic structure is the roof (4) of the vehicle.

6. A system according to claim 4 or 5, characterised in that the stripped end of the cable is fastened to a vehicle seat by a rapid release connector.

7. A system according to claim 1, characterised in that the antenna pair (1,2) is fixed to a window (5) of the vehicle and galvanically connected (8) with each other by a cable conducted through the window or through a packing between the window and the vehicle body.

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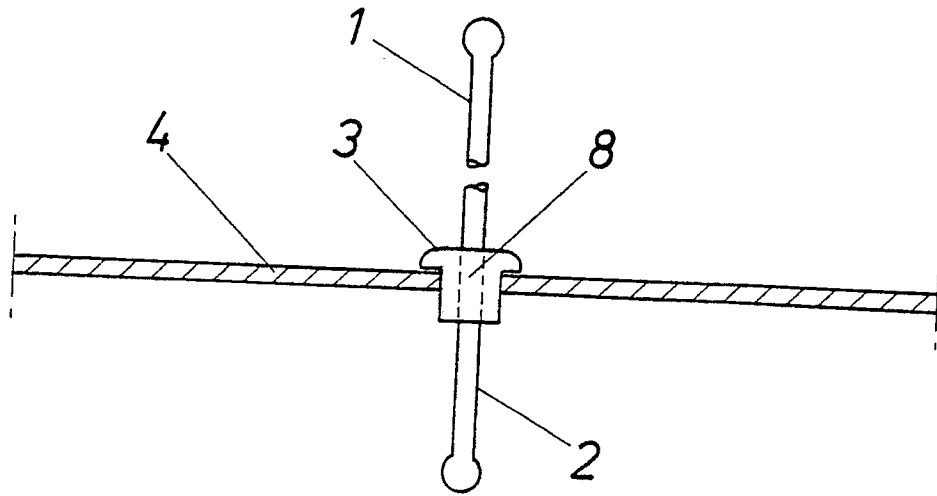
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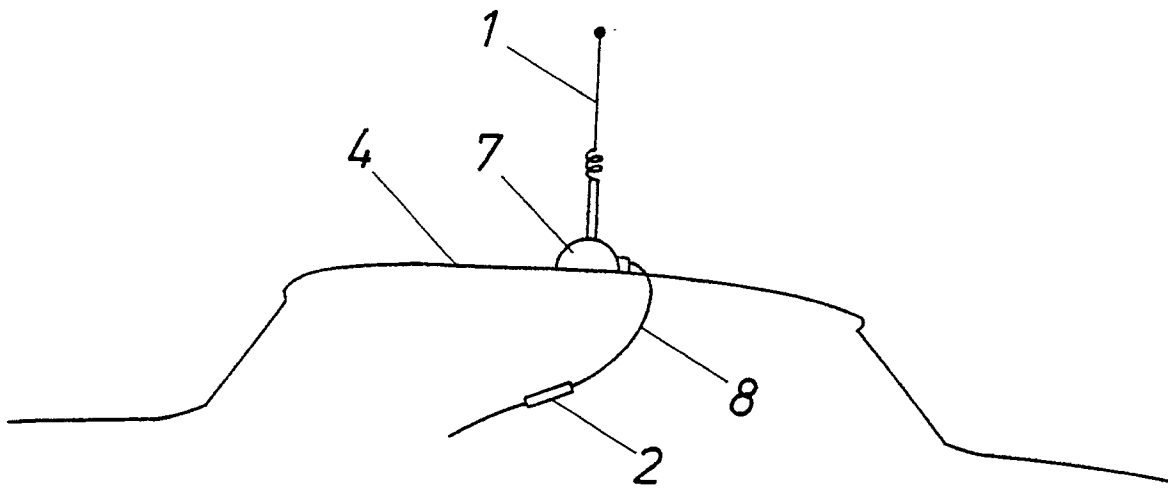
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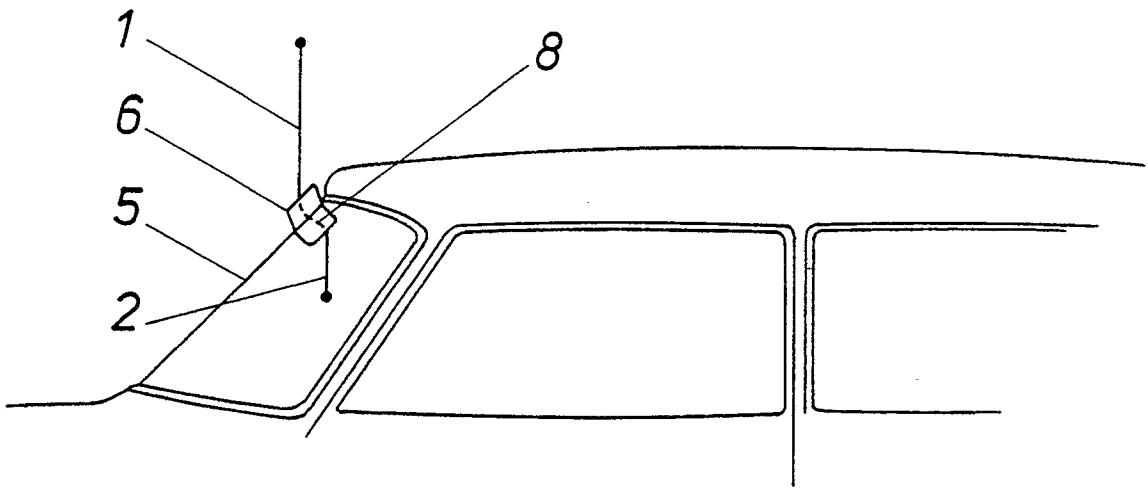
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*Fig. 1*



*Fig. 2*



*Fig. 3*



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	FR-A-2 081 211 (COMPAGNIE DE SAINT-GOBAIN) * page 2, lines 5 - 31 ** page 3, lines 20 - 33; figures 1-6 * - - -	1,2	H 01 Q 1/32 H 04 B 7/145
X	DE-A-3 537 107 (LICENTIA) * abstract; figure * - - -	1	
A	DE-A-3 526 527 (FROMM) * claims 1-3; figure 1 * - - -	1,3,5	
A	US-A-4 613 833 (HARADA) * abstract; figures 4, 5 * - - -	1,2,5	
A	EP-A-0 330 780 (BLAESE) * abstract; figures 1-3 * - - - - -	1,2,7	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			H 01 Q H 04 B H 04 Q
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of search 04 February 91	Examiner ANGRABEIT F.F.K.
<b>CATEGORY OF CITED DOCUMENTS</b> X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention		E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons ..... &: member of the same patent family, corresponding document	